

WHAT IS CLAIMED IS:

1. A fuel supply system for a direct fuel injection type internal combustion engine comprising:

a high-pressure fuel pump;

injectors for injecting directly fuel pressurized by said high-pressure fuel pump into respective combustion chambers of said engine, and

an auxiliary power unit connected with said high-pressure fuel pump,

wherein at a time of starting of said engine, driving of said high-pressure fuel pump or an assist to drive torque for said high-pressure fuel pump is performed by said auxiliary power unit.

2. The fuel supply system according to claim 1, wherein said auxiliary power unit is an electromotor.

3. The fuel supply system according to claim 2, wherein said electromotor is a motor generator which can be used also as generator when being made to drive by the cam shaft of said engine.

4. The fuel supply system according to claim 3, wherein said camshaft and said high-pressure fuel pump are connected with each other by a one-way clutch.

5. The fuel supply system according to claim 1, wherein a drive shaft of said high-pressure fuel pump and an output shaft of said auxiliary power unit are connected

with each other by a power transmission mechanism.

6. The fuel supply system according to claim 1, wherein a clutch is provided between said high-pressure fuel pump and said auxiliary power unit to connect and disconnect them.

7. The fuel supply system according to claim 6, further comprising a recognition means for recognizing completion of starting of said engine,

wherein, at a time of starting of said engine, said auxiliary power unit and said high-pressure fuel pump are connected with each other by said clutch to drive said high-pressure fuel pump by said auxiliary power unit until said completion of starting of said engine is recognized by said recognition means, and when completion of said starting is recognized, said auxiliary power unit and said high-pressure fuel pump are disconnected by said clutch to stop the operation of said auxiliary power unit.

8. The fuel supply system according to claim 7, wherein said recognition means recognizes starting of said engine based on an engine coolant water temperature, an engine oil temperature or a temperature of a catalyst in an exhaust system of said engine, and when said engine is started up at a temperature higher than the temperature for recognizing starting of said engine, said high-pressure fuel pump is driven by said camshaft from immediately after

starting of said engine without using said auxiliary power unit.

9. The fuel supply system according to claims 1, further comprising a warming up condition detection means for detecting warming up conditions of said engine, wherein driving of said high-pressure fuel pump or an assist to drive torque for said high-pressure fuel pump is performed by said auxiliary power unit only at a cold stat that said engine has not reached predetermined warming up conditions.

10. The fuel supply system according to claim 1, wherein said auxiliary power unit is driven by turning on a starter switch of said engine.

11. A fuel supply system according to claim 1, wherein said auxiliary power means is driven by turning on an ignition switch of said engine.

12. The fuel supply system according to claim 1, further comprising a sensor for detecting an action to be performed by an driver until said engine is started up, wherein based on a detection signal from said sensor, said high-pressure fuel pump is driven by said auxiliary power means prior to starting of said engine.

13. The fuel supply system according to claim 12, wherein said engine is used for a vehicle such as an automobile, and said sensor for detecting said action by said driver is any one of a door lock release sensor for

detecting a release of a door lock of said vehicle, a door open/close sensor for detecting opening and closing of a door of said vehicle and a seating sensor for detecting seating of said driver on an driver's seat of said vehicle.

14. The fuel supply system according to claim 12, wherein when a starter switch of said internal combustion engine is not turned on even after a predetermined time has elapsed from input of said detection signal from said sensor for detecting said action by said driver, said driving of said high-pressure fuel pump by said auxiliary power unit is stopped.

15. The fuel supply system according to claim 14, wherein when said starter switch is turned on after a predetermined time has elapsed from said input of said detection signal from said sensor for detecting said action by said driver, said high-pressure fuel pump is driven by said camshaft, and said high-pressure fuel pump is also driven by said auxiliary power unit.

16. A fuel supply system according to claim 15, wherein said driving of said high-pressure fuel pump by said auxiliary power unit after said starter switch is turned on is performed only at a cold start that said engine has not reached predetermined warming up conditions, and at a time point that said warming up conditions have reached said predetermined warming up conditions, said

driving of said high-pressure fuel pump by said auxiliary power unit is stopped.

17. The fuel supply system according to claim 1, further comprising a low-pressure fuel pump for pumping up fuel from a fuel tank, wherein said high-pressure fuel pump is fed with fuel by said low-pressure fuel pump.

18. A fuel supply system for a direct fuel injection type internal combustion engine comprising:

a low-pressure fuel pump for pumping up fuel from a fuel tank;

a high-pressure fuel pump for being fed with fuel from said low-pressure fuel pump, pressurizing said fuel from said low-pressure fuel pump and supplying said pressurized fuel to each injector such that said fuel pressurized by said high-pressure fuel pump is injected directly into each combustion chamber of said engine from said injector, wherein said high-pressure fuel pump is an electric pump driven by an electromotor.

19. A fuel supply method for a direct fuel injection type internal combustion engine comprising:

pressurizing fuel from a fuel tank with a high-pressure fuel pump;

injecting directly fuel pressurized by said high-pressure fuel pump into each combustion chamber of said engine with each injector in turn;

connecting said high-pressure fuel pump with an auxiliary power unit in addition to a camshaft, and at a time of starting of said engine, driving said high-pressure fuel pump or assisting drive torque for said high-pressure fuel pump by said auxiliary power unit.